



UNIVERSITI PUTRA MALAYSIA

**EVALUATING THE EFFECTIVENESS OF
TOTAL PRODUCTIVE MAINTENANCE (TPM) PROGRAM
IN TEXAS INSTRUMENTS MALAYSIA.**

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**Evaluating The Effectiveness Of
Total Productive Maintenance (TPM) Program
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by

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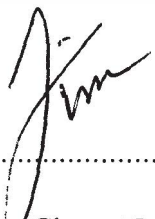
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Saya, Lim Cheng Hoe (Matrik Nombor 51311), pelajar program Master in Business Administration (MBA) mangakui bahawa kajian laporan untuk kursus ini adalah hasil asal saya sendiri.

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DEDICATION

I would like to dedicate this research project to my lovely wife and children, Lam Suet Fern, Lim Hui Chee, and Lim Hui Yuen for their understanding, patience and support throughout the MBA program. Lastly, to my parents, Lim Ba and Ng Sai Kim who always show their support to the children's education.

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LIST OF ABBREVIATIONS

| | |
|--------------|--|
| AITPM | American Institute of Total Productive Maintenance |
| AM | Autonomous Maintenance |
| CM | Corrective Maintenance |
| EM | Equipment Management |
| FTZ | Free Trade Zone |
| GDP | Gross Domestic Product |
| JIPE | Japan Institute of Plant Engineers |
| JIPM | Japan Institute of Plant Maintenance |
| JIT | Just-In-Time |
| KK | Kobetsu-Kaizen |
| MP | Maintenance Prevention |
| MTBF | Mean Times Between Failure |
| MTTR | Mean Times To Repair |
| OEE | Overall Equipment Effectiveness |
| PM | Preventive Maintenance or Productive Maintenance or Planned Maintenance |
| SPC | Statistical Process Control |
| TI | Texas Instruments |
| TIM | Texas Instruments Malaysia |
| TPM | Total Productive Maintenance |
| TQC | Total Quality Control |
| TQM | Total Quality Management |
| YMC | Yamaha Motor Co. |
| YMMC | Yamaha Motor Manufacturing Corp. |

Abstract of research paper submitted to the Senate of Universiti Putra Malaysia in fulfillment of the requirements for the degree of Master of Business Administration.

**Evaluating the Effectiveness of Total Productive Maintenance (TPM)
Program In Texas Instruments Malaysia.**

By

LIM CHENG HOE

August 1998

Supervisor : Professor Dr. Mohd. Ghazali Mohayidin

Faculty : Economics & Management

Today, the economic environment surrounding corporations becomes severe, and total elimination of waste is required for the survival of the corporation. Therefore, wastes generated due to the failure shutdown of facilities that have been built with huge investment and wastes such as defective products should be absolutely eliminated. Requirements for product quality become stringent, and not even one defective product would be allowed. Quality assured delivery of total quantity is now taken for granted. Thus in order for organization to remain competitive, reduce production cost, and meeting stringent product quality requirements, Total Productive Maintenance (TPM) was introduced and has been recognized as necessary for organization survival.

The purpose of this research is to determine the effectiveness of the TPM program in TIM. Specifically, this study aimed :

- To understand the TPM program.
- To determine the effectiveness of TPM in achieving the organization operation productivity, operation cost and product quality.
- To determine the constraints and issues during TPM fan-out plant wide in TIM.
- To discuss the managerial implications of the results.
- To provide information regarding the implementation of TPM program that may be useful to other research purposes regarding implementing TPM program.

Based on this study, it can be concluded that, TIM has achieved the objectives through the implementation of TPM program. With better equipment performance and productivity, the cost of operation and costs per unit in TIM could be reduced. With the lower cost of operation, this will improved the ability for TIM to compete in the industry. The implementation of TPM program in TIM helped TIM achieved a lot of tangible and intangible benefits, where this benefits increased the organization image and status in the industry.

ABSTRAK

Penilaian Keberkesanan Program “TPM” Di Texas Instruments Malaysia.

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Pada masa kini, keadaan ekonomi yang mengelilingi sesebuah korporat menjadi amat penting. Untuk korporat terus wujud, menghapuskan semua pembaziran dalam korporat adalah sangat diperlukan. Oleh itu, pembaziran terjadi daripada kerosakkan kemudahan-kemudahan di dalam kilang dan pengeluaran produk yang bermutu rendah patutnya dihapuskan. Keperluan produk yang bermutu tinggi menjadi lebih hebat, dan penerima tidak akan menerima sesuatu produk yang bermutu rendah. Kesemua produk yang dihantar itu mesti memenuhi ciri-ciri mutu yang tinggi. Dengan itu, untuk organisasi terus bersaing, iaitu mengurangkan kos pengeluaran dan mengeluarkan produk bermutu tinggi, TPM telah dipekenalkan dan diakui sebagai satu cara untuk organisasi meneruskan operasinya dalam industri tersebut.

Tujuan utama penyelidikan ini adalah untuk menentukan kesan pelaksanaan TPM di Texas Instruments Malaysia (TIM). Tujuan yang lebih khusus adalah :

- Untuk memahami program TPM di TIM.
- Untuk menentukan kesan pelaksanaan program TPM untuk mencapai keupayaan pengeluaran, kos pengeluaran dan kualiti produk dalam organisasi.
- Untuk menentukan halangan dan masalah yang dihadapi semasa melaksanakan program TPM secara keseluruhan dalam kilang.
- Untuk membincangkan implikasi penemuan kajian.
- Untuk memberi informasi mengenai pelaksanaan program TPM yang mungkin berfaedah kepada penyelidik-penyelidik yang ingin melakukan penyelidikan tentang pelaksanaan TPM.

Berdasarkan penyelidikan ini, didapati bahawa TIM telah mencapai objektifnya melalui pelaksanaan program TPM. Dengan meningkatnya prestasi mesin dan seterusnya produktiviti, kos pengeluaran untuk TIM telah dapat mengurangkan. Kos pengeluaran yang rendah ini berkemungkinan akan meningkatkan keupayaan TIM untuk bersaing dalam industrinya. Dengan pelaksanaan program TPM, TIM telah mencapai banyak faedah, dimana faedah-faedah yang tercapai telah meningkatkan imej dan kedudukannya dalam industri.

CHAPTER I

INTRODUCTION

The manufacturing sector plays a significant role in the success of the industrial development in Malaysia. It's contribute to the Malaysian Gross Domestic Product (GDP) growth, and the GDP had increased from 13.9% in 1970 to 27.0% in 1990. The GDP will expect to account for another 40% by the year 2020 when Malaysia becoming a fully industrialized nation (Ali, 1993). The future of Malaysia economy will be relying heavily on the well being of the manufacturing industries.

In order to be an industrialized nation, the Malaysia Government started encourage investor from foreign investment at the Free Trade Zone (FTZ) with cheaper cost of operation. In 1972, FTZ were opened following the Free Trade Zone Act 1971, Penang and Selangor became main recipient of foreign investments (Jomo K.S. & Ng Suew Kiat, 1996). With this incentive, multinational company from United State (US) and others' countries set up their operation in Malaysia especially the electronic manufacturing company.

Today, the economic environment surrounding corporations becomes severe, and total elimination of waste is required for the survival of the corporation. Therefore, wastes generated due to the failure shutdown of facilities that have been built with huge investment and wastes such as defective products should be absolutely eliminated. Requirements for product quality become stringent, and not even one defective

product would be allowed. Quality assured delivery of total quantity is now taken for granted.

Avoidance of the three Ds (Difficult, Dirty and Dangerous), worker preference for employment in the service industry and shorter working hours can be seen as a spreading tendency, making the acquisition of a sufficient work force more difficult. Increases of the aged and higher education in our society have also contributed to making the maintenance of conventional production facilities difficult.

The small lot productions of various kinds of products and shortening of production lead time have been strongly required to meet diversified customer needs. Thus in order for organization to remain competitive, reduce production cost, and meeting stringent product quality requirements, Total Productive Maintenance (TPM) was introduced and has been recognized as necessary for organization survival.

Background of Texas Instrument Group

Texas Instruments (TI) Incorporated, headquarters in Dallas, Texas, USA is a high-technology company with sales or manufacturing operation in more than 30 countries. TI products and services include semiconductors, defense electronics systems, software productivity tools, printers, notebook computers and consumer electronics products, custom engineering and manufacturing services, electrical controls and metallurgical materials. TI has the world's best geographic coverage in the semiconductor industry. In Europe, TI has five manufacturing sites, with two advanced wafer fabrication centers, and 28 sales and marketing locations. In Asia, TI has five wholly owned and five joint ventures manufacturing sites, and nine sales and marketing locations. In Japan, TI has four wholly owned and one joint venture manufacturing site, and 10 sales locations. TI have been in each of these regions for more than 30 years.

Texas Instruments Semiconductor Group provides innovative solutions in more than 15,000 products worldwide in the computer, communications, consumer, automotive, military and industrial markets. TI offers a unique breadth of digital and mixed-signal and analog products and technologies, hardware and software development tools, design information services and global support.

Development of Manufacturing Management Expertise

Quality management is important because of its impact on market share, price, and profits. Four major categories of costs associated with quality management are prevention, appraisal, internal failure, and external failure. If quality is to be improved, prevention costs must increase. Appraisal, internal failure, and external failure cost all decrease as quality is improved through preventive measures (Krajewski and Ritzman, 1996).

In 1970, Consumer demand for high-quality products and services and the need for firms to improve their operations to make quality a competitive priority. To be competitive in the industries, manufacturing firms introduce and implement improvement and quality program. The programs are Just-in-time (JIT) and Total Quality Management (TQM).

Just-in-time (JIT) addresses the materials cost component of productivity. JIT is an inventory control system where the objectives are reducing the lot size, reduce setup times, and reduce purchase order costs (Schonberger, 1982). Just-in-time (JIT) systems are designed to produce or deliver just the right products or services in right products or services in just the right quantities just in time to serve subsequent production processes or customers. Some of the key elements of JIT systems are a pull method to manage materials flow, consistently high quality, small lot sizes, short setup times, uniform workstation loads, standardized components and work methods,

close supplier ties, flexible work force, product focus, automated production, preventive maintenance, and continuous improvement

Total Quality Management (TQM) stresses three principles customer satisfaction, employee involvement, and continuous improvements in quality TQM also involves benchmarking, product and service design, purchasing, and problem-solving tools.

The latest development for manufacturing is implementing TPM to improve the equipment effectiveness and improve the knowledge of the machine operators. TPM program is another improvement program to increase the competitiveness of the manufacturing firm.

Development of TPM in Texas Instruments Malaysia (TIM)

TI's operations in Malaysia assemble and test semiconductors, manufacture products for TI's Materials and Controls business and make radio frequency identification devices located at Ulu Klang FTZ area, Selangor. TI is one of the pioneers in the Malaysian electronics industry, growing from just 200 people in 1972 to more than 3,500 today. It is a success story that is founded on our commitment to a total quality culture. This commitment has been recognized by our customers, the Malaysian government and our peer companies. TIM has received the Quality Management of International Trade Award from the Malaysian Ministry of International Trade and Industry, and have also won recognition from the Standards and Industrial Research Institute of Malaysia and the International Standards Organization.

TIM's participate management style provides for self-managed work groups that share equal responsibility with management to make their own decisions on meeting quality and production goals. As a result of self-managed teams and total quality programs, productivity has improved three-fold and factory output has more than doubled. TIM implemented the TPM concept in 1990 with forming a task force team to launch and implement the TPM in TIM plant wide. In the early year, the task of implementing TPM had given to a section head. His role was to advise others' department how to implement TPM. Training was provided to all personnel who involved in TPM, however no emphasis and support from top management. After a year, the launching

and implementing TPM in TIM failed, and the TPM project delay by TIM management

In 1993, TIM re-launched the TPM and header by equipment manager with his task force team. Although now with more specific group but management commits same mistake again. Without total management commitment, the project failed and delays once more time.

In March 1996, the TPM project is started again (3rd attempt). This time, the TPM task force team headed by the Managing Director of TIM and the members included all the top department manager in TIM. Consultant from Japan Institute of Plant Maintenance (JIPM) was hired to help launching and implementing TPM program in TIM. A TPM office has been set-up to assist the launching and implementing TPM program.

In this time, all department managers will own a pilot machine as a model machine with selective area personnel to be the model machine team members. The team members for each model machine are header by a department manager, two section managers, three engineers, a facilitator, two technicians and four operators. With this new TPM organization structure, the launching and implementing TPM was been able to proceed beyond the infant stage.

After 21 months, all pilot machines showed a big improvement, the equipment OEE and throughput increased to 60%, the equipment downtime reduced to 25%, spare

cost reduced 40%, and the product defect rate decreased 20%. The TIM management felt the benefit from the TPM implemented from all the pilot machines, in January 1998, the management decided to fan-out and implements TPM to all the machines in TIM plant wide.

Concept of TPM

TPM is the Japanese approach to maximizing the effectiveness of the facilities that we use within our business. It not only addresses maintenance but all aspects of the operation and installation of those facilities, and at its very heart lies the motivation and enhancement of the people who work within the company (Davis, 1995). TPM aiming at forming a corporate culture that can pursue the maximum possible efficiency of the overall production system. TPM is a new way of thinking about organization, and how people should relate, and work in them. It refers to efficient management of an organization, which in turn meets customer needs. Customers' satisfaction is the pivot of current business management philosophy.

The concept of TPM is a program in its own right. It involves a philosophical change to achieve excellent performance. To pursue the maximum possible efficiency of the overall production system, TPM must be developed with all the company department participation. The target is to change the people's mind or behavior, and to change the corporate culture. TPM is an all-worker-participation type management, and priority is given to respecting the human being.

TPM is aiming to restructure the corporate culture through improvement of human resources and plant equipment. What the improvement of human resources means is educating and fostering the employees who can respond to the new demands of Factory Automation.